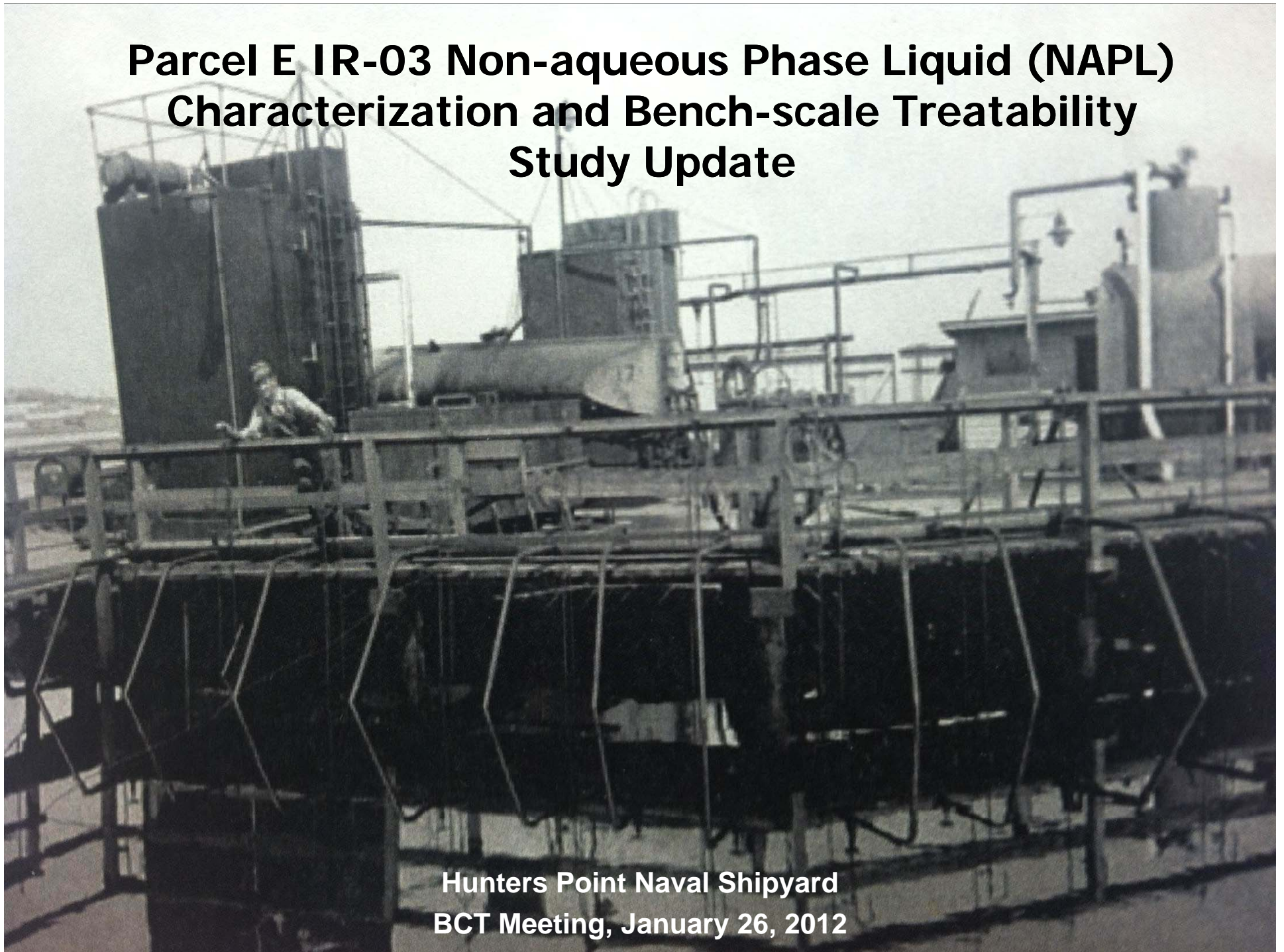


Parcel E IR-03 Non-aqueous Phase Liquid (NAPL) Characterization and Bench-scale Treatability Study Update



**Hunters Point Naval Shipyard
BCT Meeting, January 26, 2012**



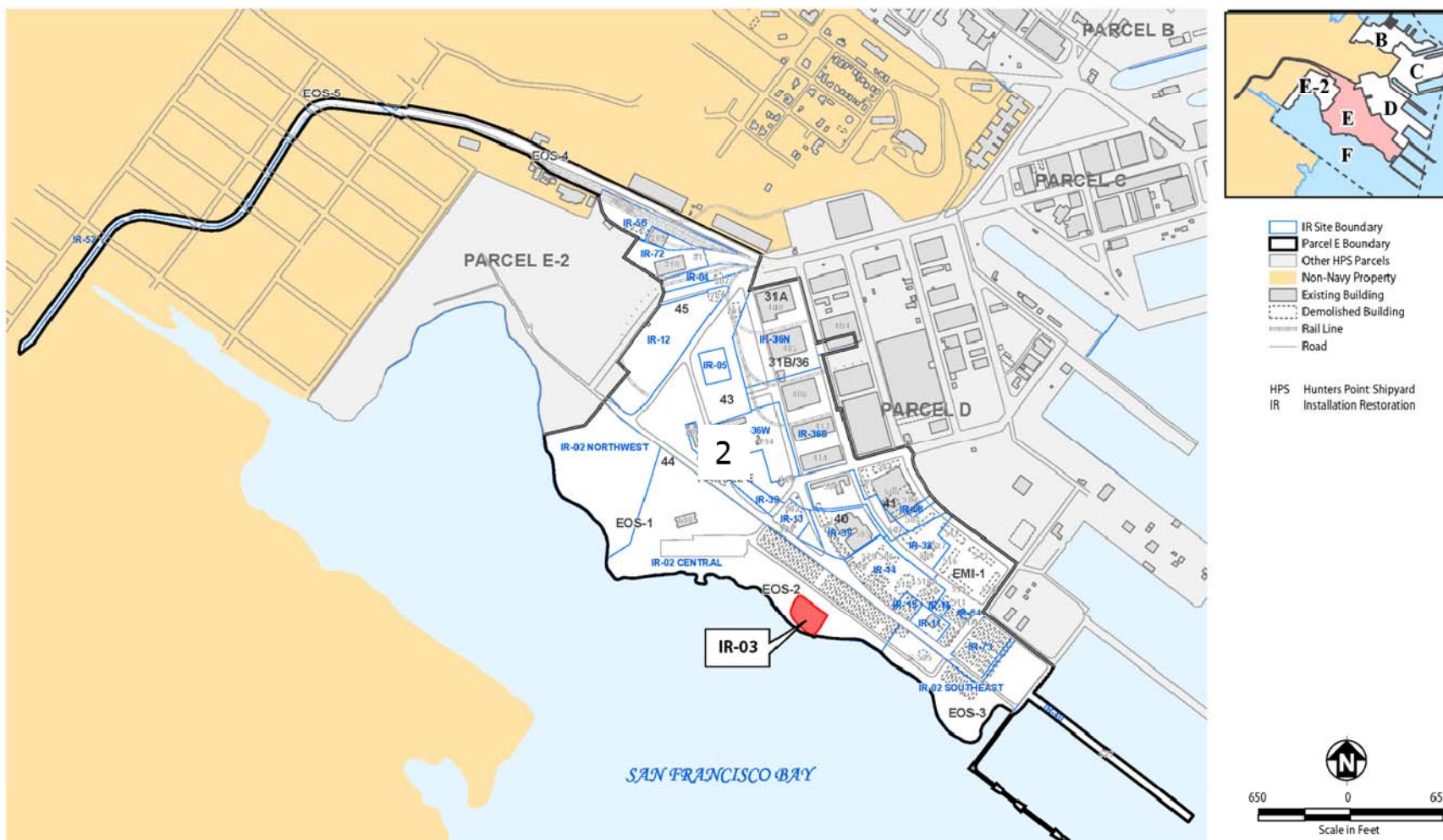
Presentation Overview



- **NAPL Characterization**
 - IR-03 Soil Lithology
 - Lateral and Vertical NAPL Extent
 - Contaminant of Concern (COC) Concentrations in Soil and Groundwater on NAPL fringe
 - Radiological Characterization
- **Bench-Scale TS**
 - Geotechnical Results and Treatability Study (TS) Sampling
 - Density and viscosity properties of NAPL as function of Temperature (30 to 90°C)
 - Characterization of NAPL-impacted Composite Soil



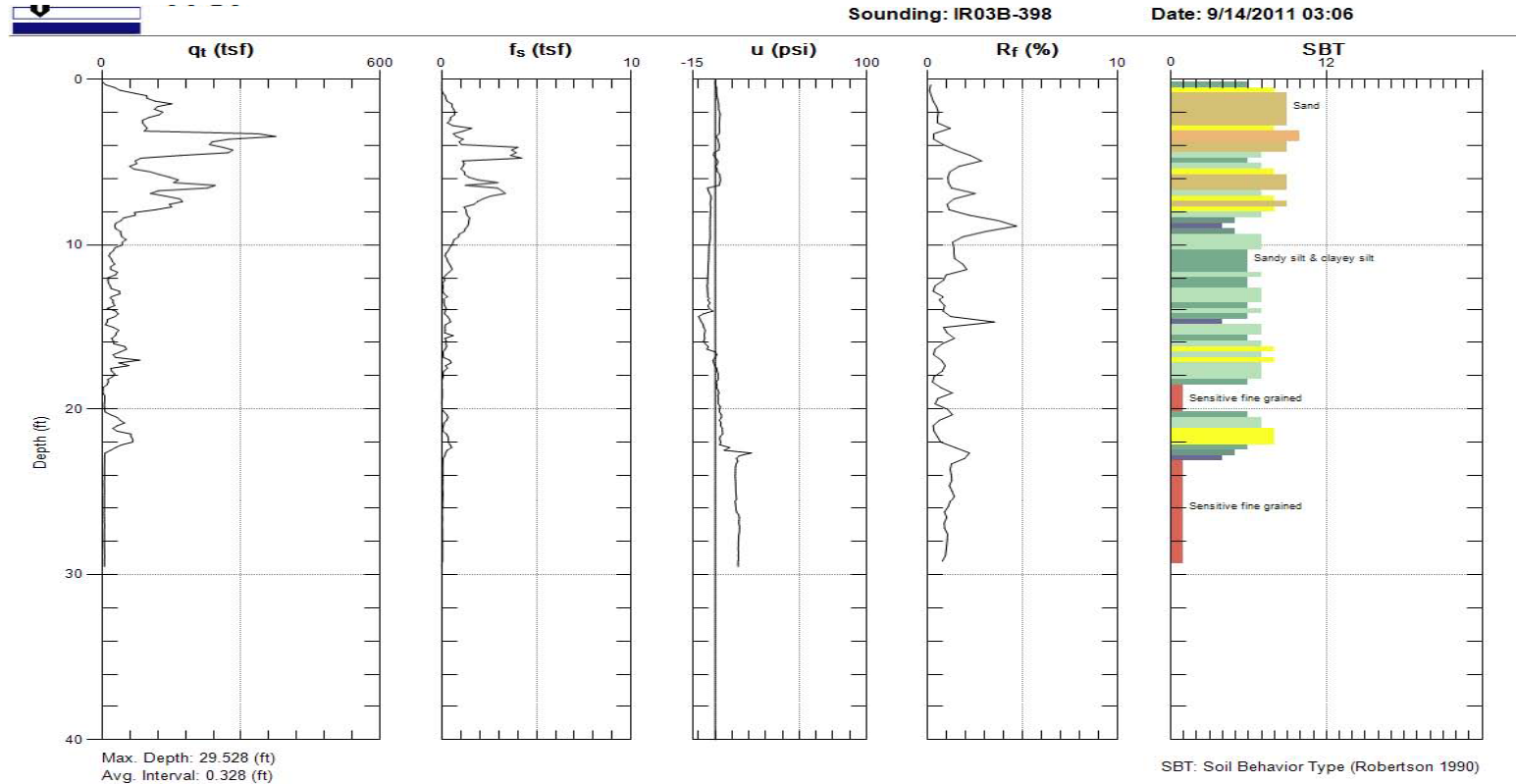
Site Location



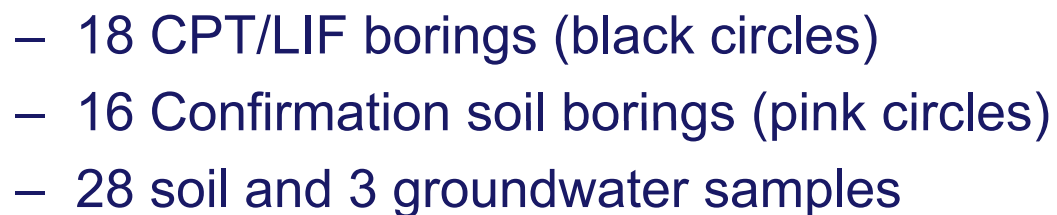
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IR-03 Soil Lithology



q_t = cone resistance, f_s = sleeve friction, u = pore pressure, R_f = friction ratio





Characterization of NAPL Extent



- **Extent of NAPL Determined Based on Multiple Inputs from NAPL Characterization Field Activities:**
 - Lateral Extent
 - Historical Existence of Measurable NAPL in Monitoring Wells
 - Detected TPH in the IR03B423 Groundwater Sample-suspect that NAPL is in the vicinity
 - Lateral and Vertical Extent
 - Laser Induced Fluorescence (LIF) Data
 - TPH Results > 3,500 mg/kg in Confirmation Soil Borings
 - Visual Observations during Logging of Confirmation and Sampling Boreholes

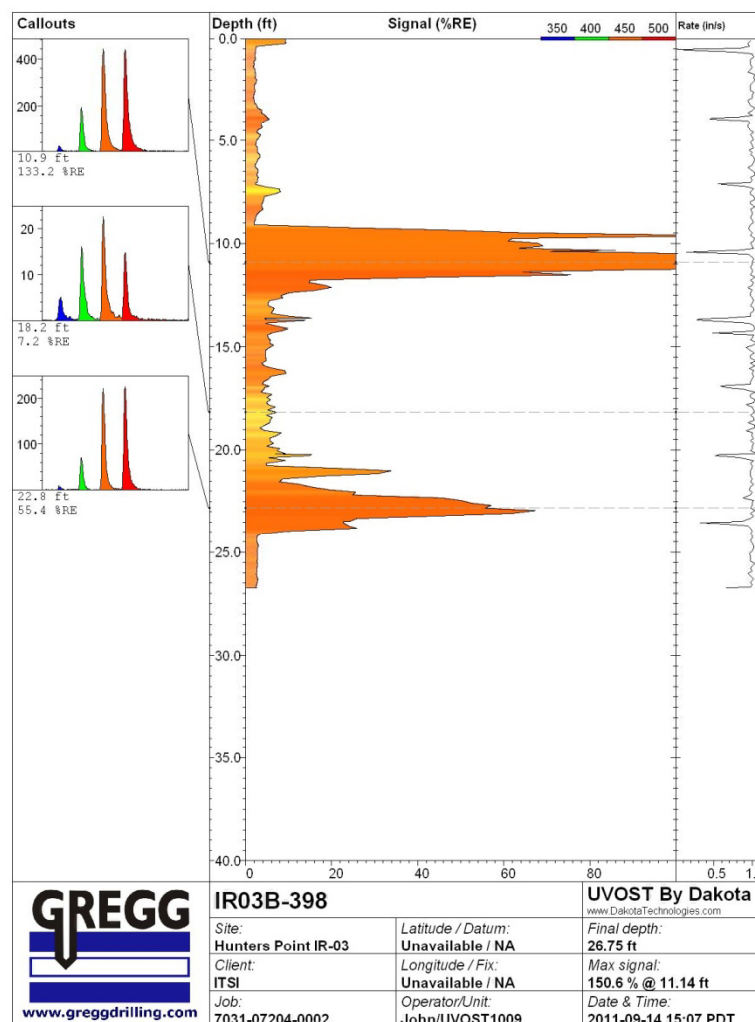


Laser Induced Fluorescence (LIF) Logs

t4



- LIF plots from 18 CPT borings
- LIF results used to initially establish lateral and vertical extent of NAPL
- Callouts – Waveforms to 'fingerprint' NAPL type – weathered diesel and motor oil
- Signal (%RE) – Total fluorescence versus Reference Emitter in %





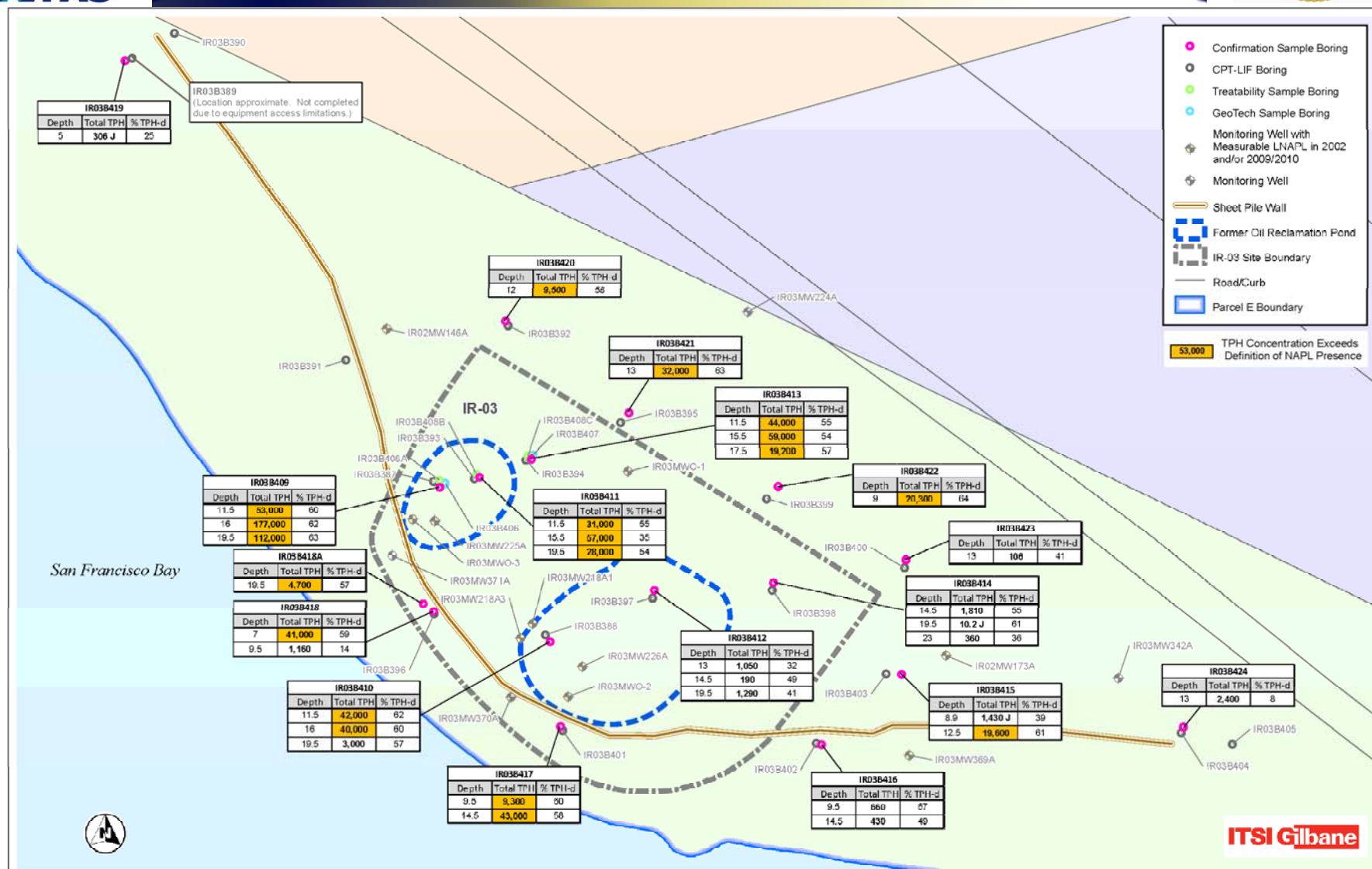
NAPL Characterization- TPH in Soil Confirmation Samples



- Completed 16 Confirmation soil borings and 28 soil samples collected
 - @ 3 depths (5 – 24 ft bgs)
 - Analyzed for TPH as Diesel (TPH-d) and Motor Oil (TPH-mo) to Quantify Total TPH
 - TPH-d and TPH-mo Detected in all Samples
 - Maximum TPH in Boring B409 @ 16 ft. bgs
 - Total TPH=177,000 mg/kg
 - TPH-d=110,000 mg/kg
 - TPH-mo=67,000 mg/kg
- NAPL Presence Estimated by total TPH > 3,500 mg/kg at 10 of 16 Borings and NAPL Encountered at 9 to 20 ft bgs
 - NAPL Estimated to be Comprised of 54% - 64% TPH-d, 36% - 46% TPH-mo based on analysis of confirmation soil boring samples

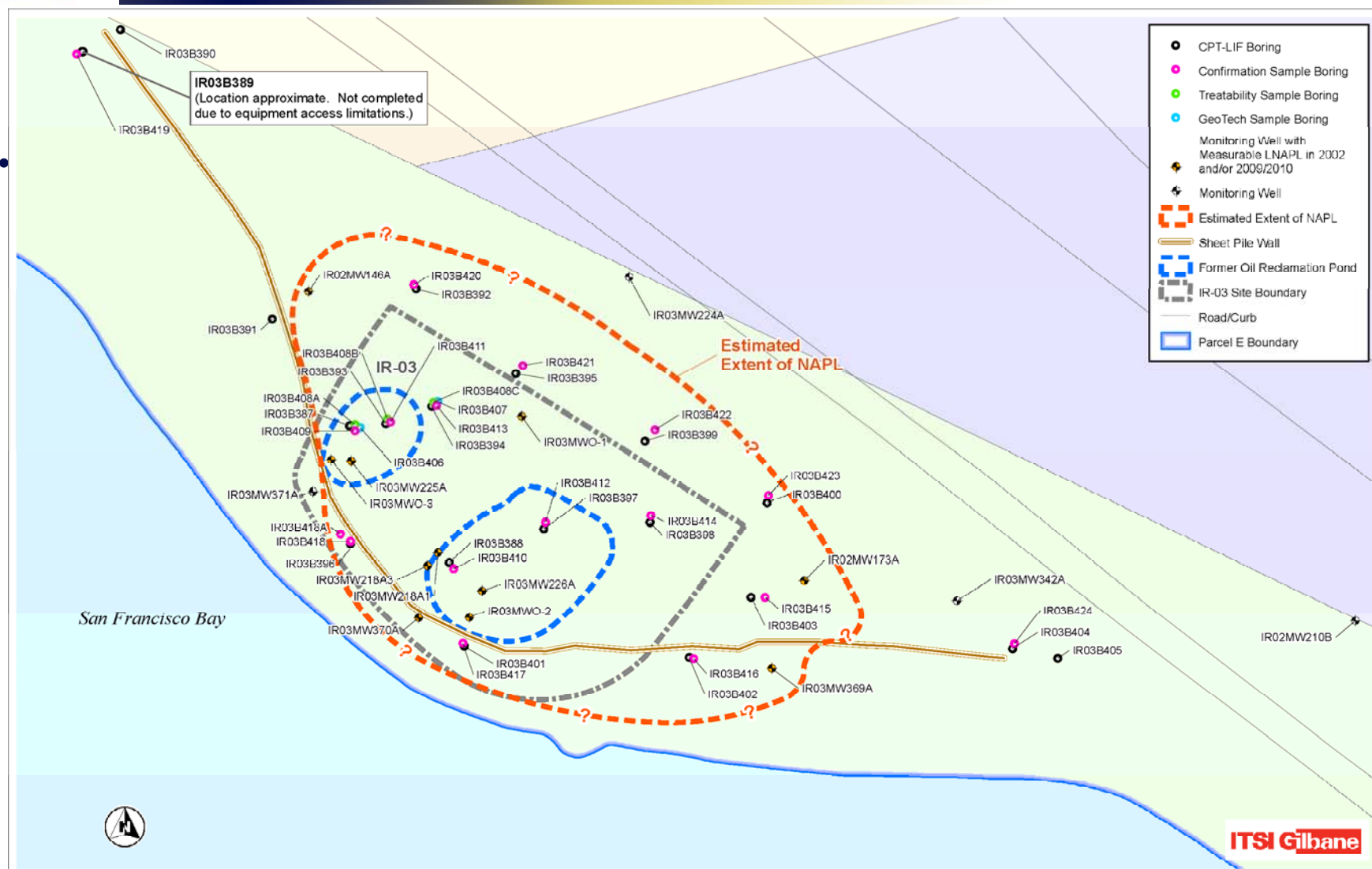


TPH Concentrations in Soil (mg/kg) from Confirmation Borings





Lateral Extent of NAPL





Vertical Extent of NAPL



- CPT Logs provided soil types and depth to Bay Mud
- LIF Logs indicated presence and depth of NAPL
- Confirmation samples for Locations with high LIF %RE had high TPH-d and TPH-mo concentrations

Boring Location	No. of Conf. Borings	Depth to Bay Mud (ft. bgs)	Depth of LIF NAPL Response (ft. bgs)	Depth of TPH >3,500 mg/kg
Pond Areas	6	18.5 - 29	8 – 22	11.5 – 23
NAPL Fringe	9	14 – 32	7 – 25	9 - 20
Outer Area	2	15 - 18	8 -12 (minor)	None

- Generally good correlation between TPH and LIF, and Bay Mud depth
- Former pond area, NAPL typically to Bay Mud



Project Screening Levels (PSC) for Selected Analytes ^{t7}



Analyte	Soil PSC (mg/kg)	Water PSC (µg/L)	Analyte	Soil PSC (mg/kg)	Water PSC (µg/L)
TPH-d	1,500	--	B(b)fluoranthene	1.3 (NE)	0.45
TPH-mo	1,850	--	Chrysene	13 (NE)	6.7
TPH-total	--	1,400	Fluoranthene	10 (NE)	16
PCB-1260	0.74	0.03	Fluorene	140 (NE)	60
1,3-Dichlorobenzene	7.4	65 (NE)	Indeno(123-cd)pyrene	1.3 (NE)	0.31
1,4-Dichlorobenzene	1.2	65 (NE)	Naphthalene	2.8	22
Vinyl Chloride	--	0.028	Phenanthrene	140 (NE)	60
B(a)anthracene	1.3 (NE)	0.65	Pyrene	1,040 (NE)	60
B(a)pyrene	0.13	0.045			

-- -- not established in the *Final Sampling and Analysis Plan* (ITSI, 2011)

NE -- not exceeded in site samples

PSC -- Project Screening Criteria found in Worksheet 15 of the *Final Sampling and Analysis Plan*, Appendix A to the *Final Work Plan Site Characterization and Bench-Scale Treatability Study for Installation Restoration Site 03, Parcel E, Hunters Point Shipyard, San Francisco, California* (ITSI, 2011)



COC Concentrations in Soil Samples from Fringe of NAPL Extent



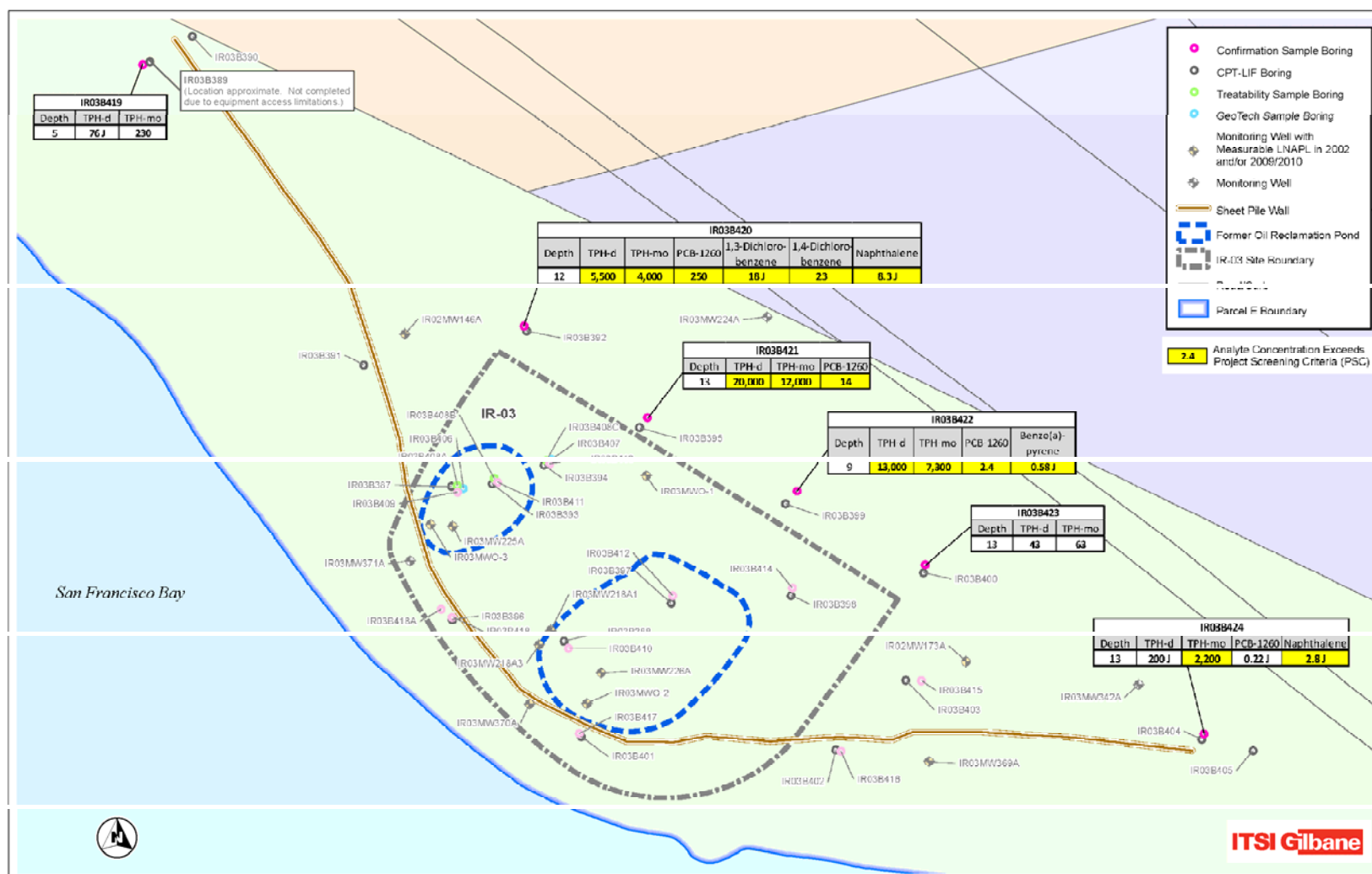
- Soil Samples from assumed NAPL Fringe (west, north, and east)
Tested for TPH, PCBs, SVOCs, and VOCs
- 6 Fringe Soil Sampling Locations (B419 through B424)
 - B419 and B423: All Concentrations < PSC
 - B420: TPH-d, TPH-mo, PCB-1260, Dichlorobenzenes, and Naphthalene > Project Screening Criteria (PSC)
 - B421: TPH-d, TPH-mo, and PCB-1260 > PSC
 - B422: TPH-d, TPH-mo, PCB-1260, and BaP > PSC
 - B424: TPH-mo and Naphthalene \geq PSC

Summary:

- TPH Results Confirm NAPL Boundary Status of B419, B423, and B424
- PSC – Project Screening Criteria found in Worksheet 15 of the *Final Sampling and Analysis Plan*, Appendix A to the *Final Work Plan Site Characterization and Bench-Scale Treatability Study for Installation Restoration Site 03, Parcel E, Hunters Point Shipyard, San Francisco, California* (ITSI, 2011)



COC Concentrations (mg/kg) in Soil Samples from Fringe of NAPL Extent





COC Concentrations in Groundwater at Fringe of NAPL Extent



- Grab groundwater samples collected from 3 Borings at Fringe of NAPL Extent: B419, B421, and B423
- Groundwater Samples Analyzed for TPH, PCBs, SVOCs, and VOCs
 - B419: Only Trace Level of benzo(a)pyrene above (>) Project Screening Criteria (PSC)
 - B421: TPH, PCB-1260, VC, and PAHs (BaP = 15µg/L) >PSC
 - B423: TPH, VC, and PAHs > PSC

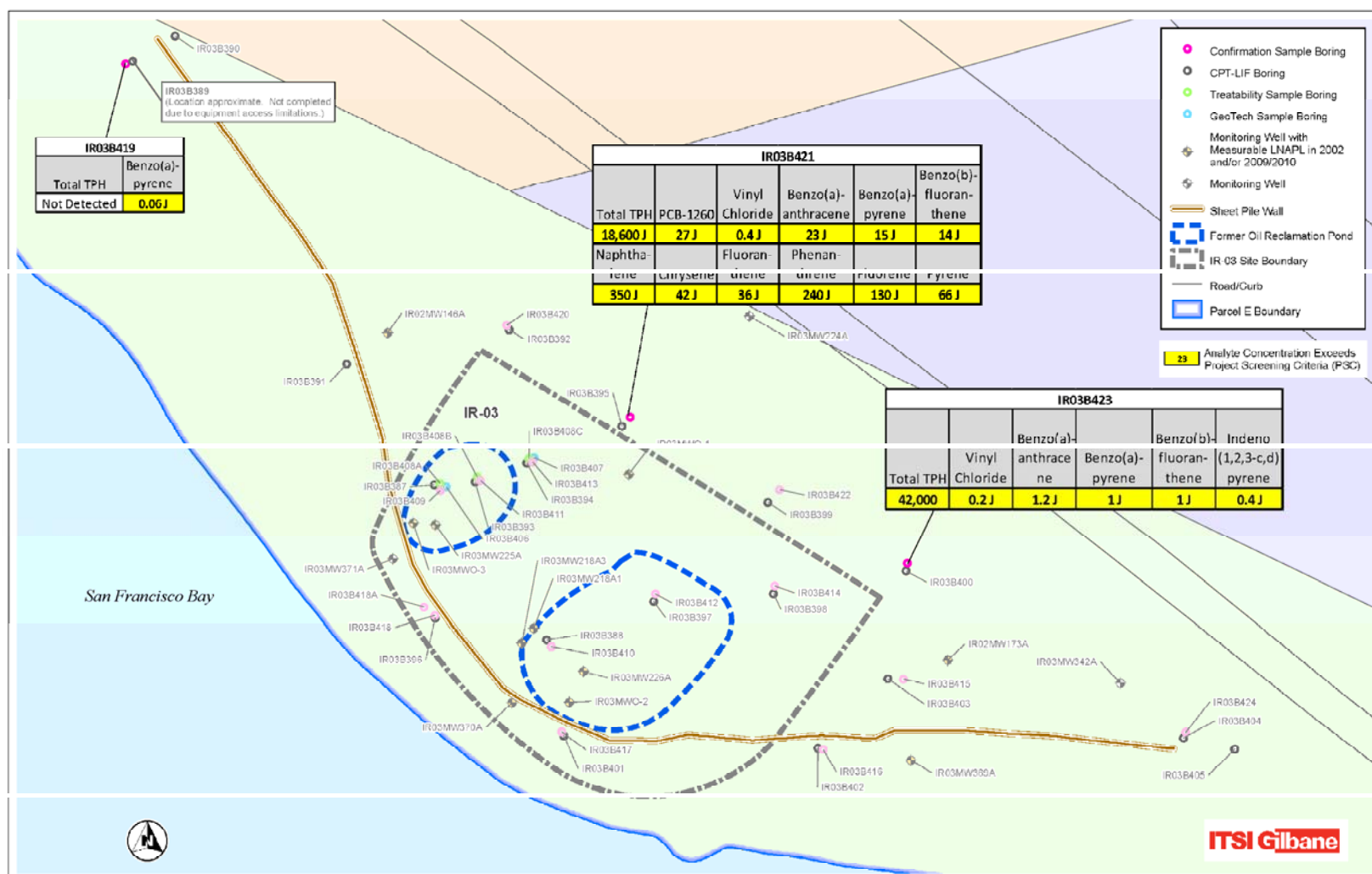
Summary

- TPH Concentrations in GW Confirm Lateral Extent of NAPL Just Beyond B423

PSC – Project Screening Criteria found in Worksheet 15 of the *Final Sampling and Analysis Plan*, Appendix A to the *Final Work Plan Site Characterization and Bench-Scale Treatability Study for Installation Restoration Site 03, Parcel E, Hunters Point Shipyard, San Francisco, California* (ITSI, 2011)



COC Concentrations in Groundwater ($\mu\text{g/L}$) from NAPL Fringe Borings



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Hunters Point Naval Shipyard, BCT, January, 2012



NAPL Hydrocarbon Composition



- NAPL Characterized for 7 Fractions within the Diesel Carbon Range (C10-C12, C12-C14, C14-C16, C16-C18, C18-C20, C20-C22, and C22-C24) and 8 Fractions within the Motor Oil Carbon Range (C24-C26, C26-C28, C28-C30, C30-C32, C32-C34, C34-C36, C36-C38, and C38-C40)
- NAPL-impacted Soil Collected at 2 Boring Locations (B406 and B407)

Boring	C10-C12 %	C12-C24 (%Diesel)	C24-C36 (%MO)	>C36 %
B406	6	54	37	3
B407	1	24	59	16

- B406: Results Similar to Estimated Ranges of Diesel and MO from TPH Data in Soil Samples from Confirmation Borings
- B407: Higher TPH-mo Fraction, and Heavier TPH Fraction relative to TPH Data in Soil Samples from Confirmation Borings.





Radiological Characterization



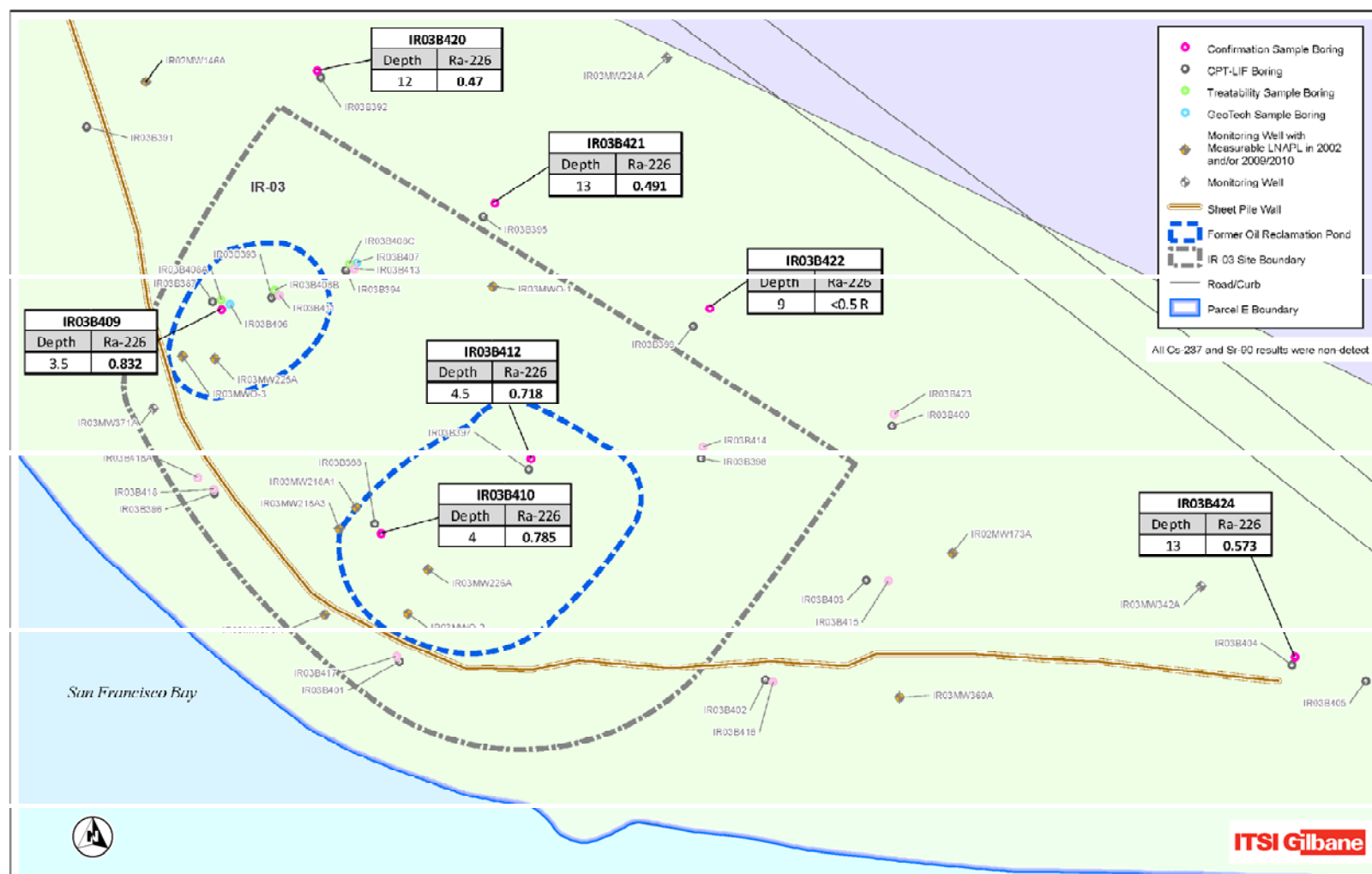
- Soil Samples from 7 Borings Analyzed for Ra-226, Cs-137, and Sr-90
- Soil Samples collected at various depths in B409, B410, B412, B420, B421, B422, and B424
- Cs-137 and Sr-90 Concentrations were Non-detect in All Soil Samples
- Low Levels of Ra-226 detected in 6 of 7 samples
- The Maximum Ra-226 result was 0.832 pCi/g in B409 at 3.5 feet bgs, less than the PSC of 1 pCi/g

Summary

- Soil at IR-03 Classified as a Mixed Waste due to Hydrocarbon and other Chemical Concentrations and Low level Ra-226 Concentrations



Ra-226 Concentrations Results (pCi/g)





Geotechnical Testing Results



- Tested for Moisture; Organic Content; Percent Gravel, Sand, and Fines; Permeability; and Hydraulic Gradient
- Two Boring Locations (B406, B407) at 3 depths

Boring	Moisture %	Organic %	Gravel %	Sand %	Fines %	Permeability cm/sec	Hydraulic Gradient
B406	6 - 37	2 - 21	9 - 37	46 - 75	8 - 16	1.5 – 8.5 E-04	5.5 - 11
B407	9 - 20	2.4 – 2.8	1 - 51	48 -79	1 - 25	1.2E-07 - 2.2E-04	6.7-14

Summary for NAPL Impacted Soil at IR-03

- Soil is Fill and primarily coarse-grained
- Geotechnical Parameters Varied Widely, as Expected in Heterogeneous Fill Material



NAPL Density/Viscosity with Temperature



- Initial Test for the Bench-Scale Treatability Study

Temperature (°C)	Density (gm/mL)	Viscosity (centipoise)
17	0.944	Not Measured
30	0.931	134.2
45	0.922	64.75
60	0.912	34.3
75	0.902	21.5
90	0.892	13.3

- Temperature Impact on NAPL Viscosity Must be Considered for NAPL Extraction at IR-03
- Draft Final FS has NAPL Recovery Alternatives with Temperatures in the 45°C and Higher Temperature Range
- Column Tests for Simulating NAPL Extractability by In-situ Thermal Treatment will be performed at 3 Temperatures



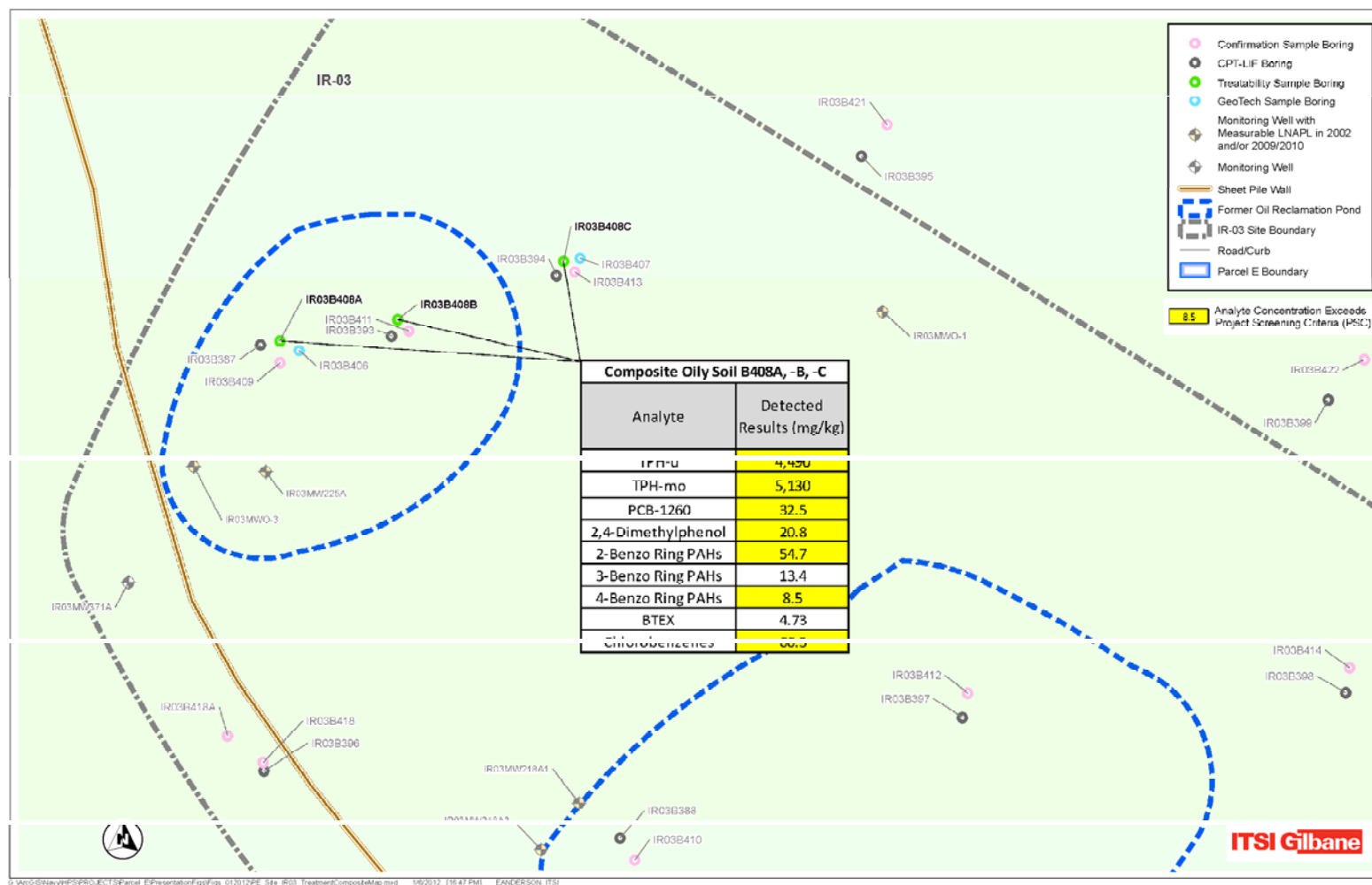
Treatability Study NAPL-impacted Soil Composite Sample Characterization



- Oily Soil collected from B408A, -B, -C, located within the estimated boundaries of the former west Oil Reclamation Pond
- Composite Sample Tested for TPH, PCBs, SVOCs (PAHs), and VOCs
- Detected Analytes included TPH-d, TPH-mo, Aroclor-1260, PAHs, 2,4-dimethylphenol, BTEX, and chlorobenzenes
- PCB-1260 and Chlorobenzenes concentrations indicate likely disposal of PCB oils to the former oil reclamation ponds
- Total TPH of the Composite consisted of 47% TPH from the Diesel Range and 53% from the Motor Oil Range



Treatability Study NAPL-impacted Soil Sampling Locations and Composite Concentrations





Bench-Scale Treatability Study



- **Column Test Temperatures**
 - 45°C
 - 65°C
 - 90°C
- **Column Tests (performed in triplicate for each temperature)**
 - Heat at Temperature for 48 hours w/ low air flow
 - Groundwater (at temperature of test) Leaching for 24 hours
 - Quantify TPH in Residual Soil, GW Leachate, Extracted NAPL, and Off-gas Samples
 - Repeat Column Test at Optimum Temperature and Characterize Residual Soil, Leachate, and Extract



Schedule



**Perform Bench-scale TS.....Oct. 2011 – May 2012
(column tests currently underway)**

Start Column Test at Optimum Temperature...March 1, 2012

Completion of TS Report.....May 11, 2012

Submit Draft Completion ReportAug. 2012

Submit Final Report.....Jan. 2013